ENERGY STAR Qualified Modular Homes **Version 2.5 Orientation**

This presentation is aligned with Version 3 (Revision 04) of the ENERGY STAR for Homes guidelines.

Learn more at **energystar.gov**

Agenda

- Overview
- Modular Program Structure
- Qualifying Homes under Version 2.5
- Inspection Checklists
- Action Items for Version 2.5
- Getting to Version 3 for Modular Homes
- Resources

Overview

Why change from Version 2?

- **Keep pace with codes and building practices**
  - Energy codes are becoming more stringent, particularly with the adoption of the 2009 IECC.
  - Energy codes are increasing more rapidly and updates will be adopted more regularly by many states.
  - Market penetration is increasing, and ENERGY STAR is becoming the standard for new home construction in some markets.
  - Increasing penetration of thermography reduces tolerance for defects.

- **Continually improve value proposition**
  - To protect its value to consumers, partners and other stakeholders, ENERGY STAR must continue to be a mark of distinction that represents significant efficiency above standard constructions practices.
  - The guidelines are augmented with building science practices that can help improve comfort, indoor air quality and durability in qualified homes.

What is Version 2.5?

- **Version 3 with allowances for transition**
  - Version 2.5 applies to homes that are ordered by the Builder between October 1, 2011 and June 30, 2012.
  - Maintains same modular program compliance verification procedures, but incorporates the new energy efficiency requirements and additional verification items on the new Inspection Checklists.

- **Version 2.5 will help partners succeed with Version 3**
  - By completing all mandatory checklists, but providing an allowance for deficiencies during this transitional period, Version 2.5 allows partners to identify what parts of the full Version 3 guidelines require further preparation and assistance.

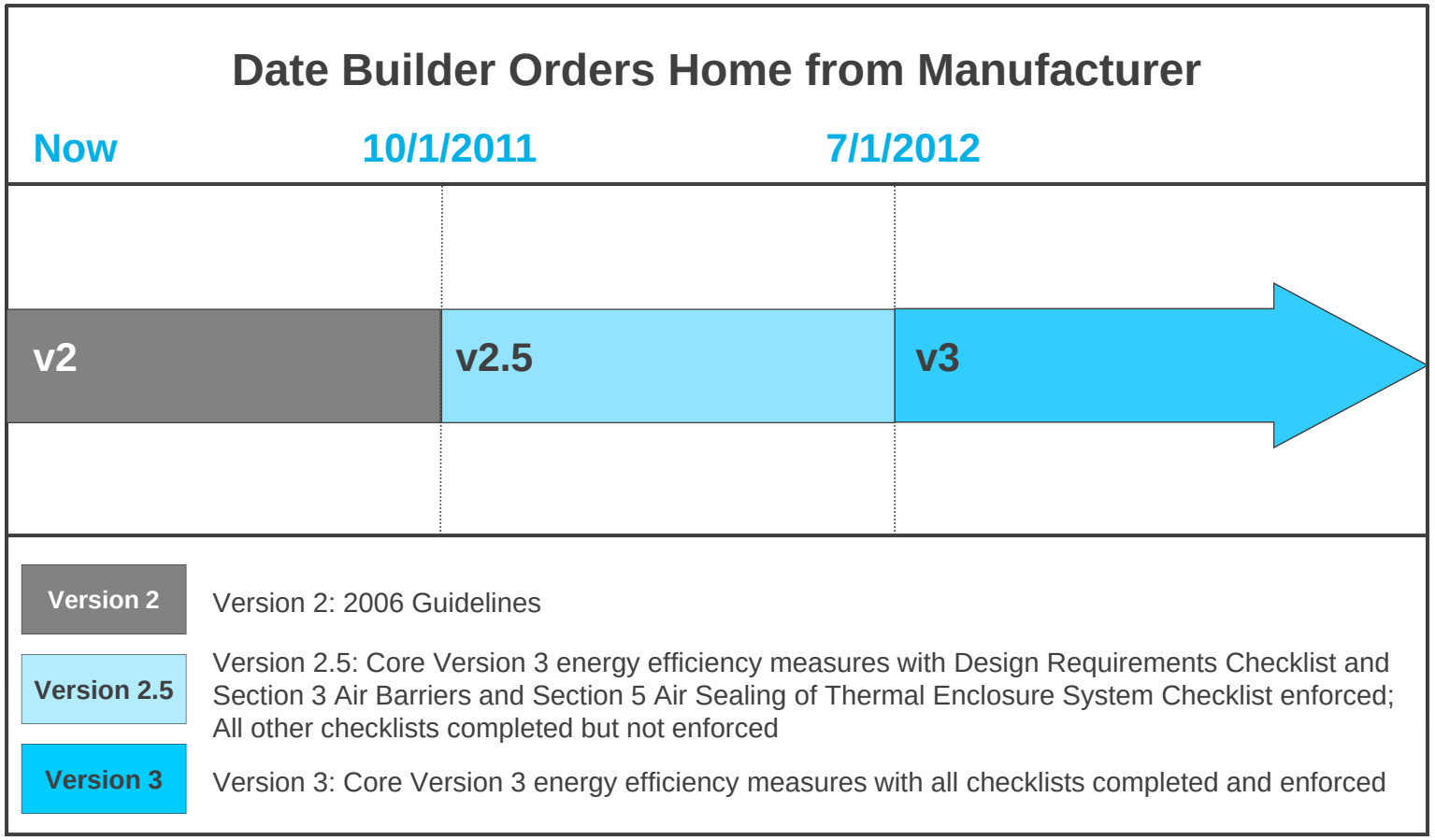
Key features of Version 2.5

- **ENERGY STAR Reference Design**
  - A set of core efficiency requirements for the building envelope, HVAC and water heating equipment, lighting and appliances.
- **Enhanced Inspection Checklists**
  - The current Thermal Bypass Checklist has been expanded into the Thermal Enclosure System Checklist and three new checklists related to HVAC System Quality Installation and Water Management Systems have been added.
  - The checklists include building science-based details that control air, thermal and moisture flows within homes to deliver improved durability, comfort and efficiency.

Key features of Version 2.5

- **Variable vs. Fixed HERS Index**
  - Instead of a fixed HERS Score, a variable HERS Index Target is calculated for each home by applying the efficiency requirements of the ENERGY STAR Reference Design.
- **Benchmark Home Size**
  - Homes larger than the average size for a specified number of bedrooms (called the ‘Benchmark Home Size’) must apply a Size Adjustment Factor that will reduce the ENERGY STAR HERS Index Target and increase the home’s energy efficiency requirements.

Implementation timeline



Modular Program Structure

The modular housing program

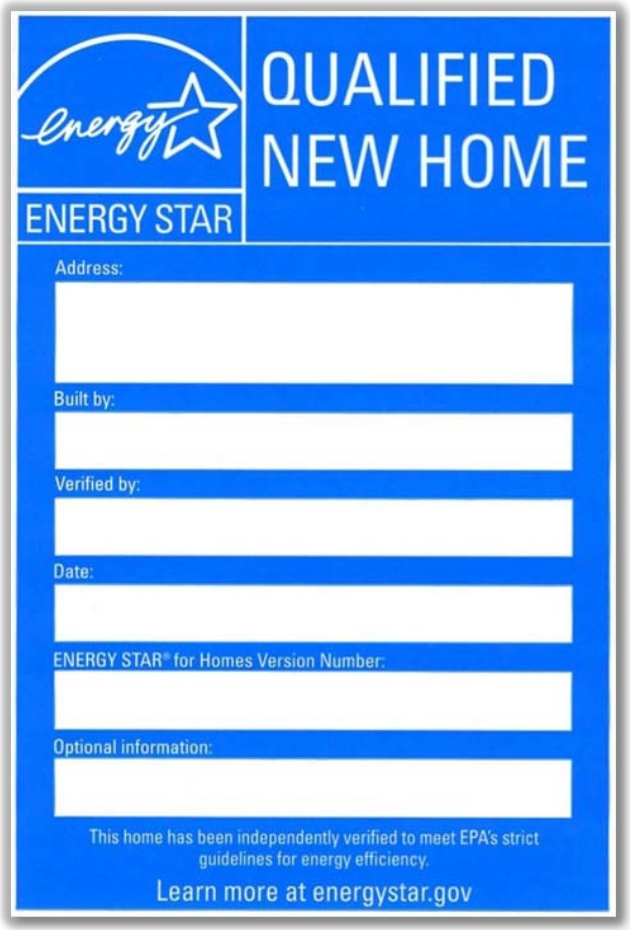
- **Energy efficiency requirements**
  - Based on **ENERGY STAR National Program Requirements** established and maintained by U.S. EPA

- **Three components unique to modular homes**
  1. Plant certification
  2. Compliance verification responsibilities divided between plant and field
  3. Reporting and labeling qualified homes

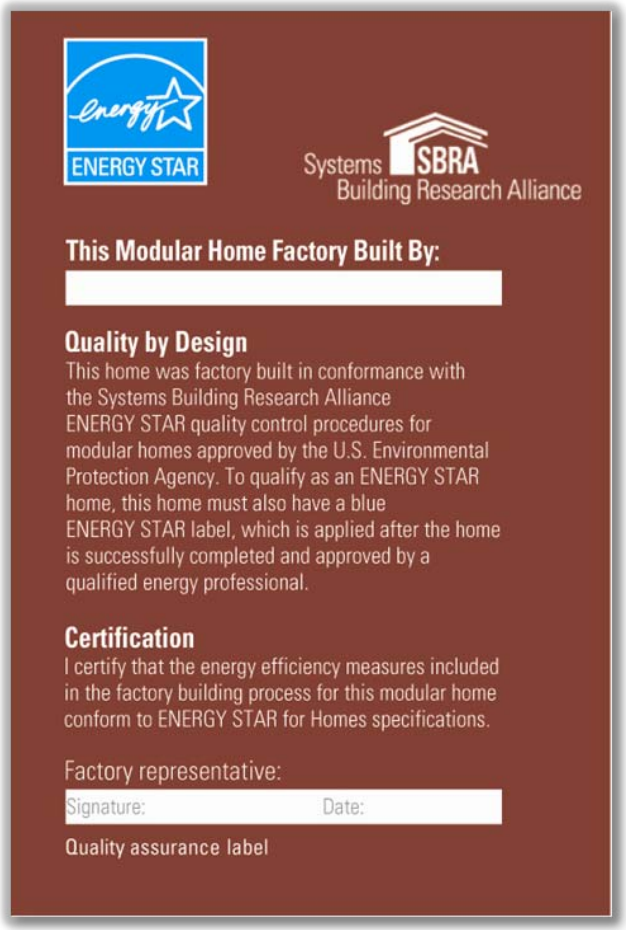
The modular housing program

Provision	Requirement
PLANT COMPLETED	
➢ **Plant Certification**	• Conducted by third-party plant Certifier • Semi-annual inspections/tests by third-party plant Certifier
➢ **Verification** (Inspection & Testing)	• Visual inspection (checklist) of all homes by plant QC staff
➢ **Labeling**	• Quality Assurance (QA) label applied in the plant by plant staff
FIELD COMPLETED	
➢ **Home Qualification**	• Conducted by third-party HERS Rater retained by Builder
➢ **Verification** (Inspection & Testing)	• Visual inspection (checklist) of all homes; responsibility for each item assigned to Builder or Rater • Testing by HVAC contractor of HVAC systems in all homes • Testing by Rater (1 in 7 minimum, plus first 2 homes per Builder)
➢ **Labeling**	• ENERGY STAR Qualified New Home label applied to home upon completion on site

Labels for modular homes



EPA's ENERGY STAR® Qualified New Home Label



SBRA's Quality Assurance Label

The role of key partners

- **Plant**
  - Retains third-party Certifier
  - Once certified, produces homes per Certifier-approved plans
  - QC staff inspects and verifies plant-installed items
  - Ships home modules to the Builder with partially-completed Inspection Checklists, flagging items to be verified in the field
- **Builder**
  - Retains third-party Rater
  - Completes homes per the Inspection Checklists
  - Verifies items flagged for field verification, including items on the **Water Management System Checklist**
- **HVAC Contractor**
  - Completes the items flagged for field verification in the **HVAC System Quality Installation Checklist**

The role of key partners

- **Certifier**
  - Reviews plant's procedures and designs; certifies the plant as conforming to ENERGY STAR and modular program requirements
  - Conducts periodic in-plant inspections for ongoing compliance

- **Rater**
  - Coordinates inspection schedule with Builder and HVAC contractor
  - Verifies items flagged for field verification on the Inspection Checklists
  - Conducts required testing and reports homes to SBRA

The role of key partners

- **EPA**
  - Establishes the ENERGY STAR guidelines and technical requirements
  - Implements ENERGY STAR partnership program for plants and builders
  - Promotes the ENERGY STAR brand nationally and supports industry promotion
  - Monitors and enforces use of the ENERGY STAR marks in promotional materials

- **SBRA**
  - As an EPA-approved Quality Assurance Provider program, develops, maintains and administers quality assurance compliance procedures for modular housing
  - Reviews reports and inspection checklists submitted by Rater
  - Issues labels and home certificate
  - Reports qualified homes to EPA quarterly

Qualifying Homes under Version 2.5

Eligible housing types

- **Eligible housing types**
  - Single family homes
  - Units in any multifamily building with 4 units or fewer
  - Units in multifamily buildings with 3 stories or fewer
  - Units in multifamily buildings with 4 or 5 stories above-grade that have their own heating, cooling and hot water systems and where dwelling units occupy 80% or more of the building area

Units in multifamily buildings that are not eligible to earn the ENERGY STAR through the New Homes Program may be eligible through the **Multifamily High Rise Program**.

Qualifying homes under Version 2.5

1. Compare home size to **Benchmark Home Size**
2. Select either **Prescriptive** or **Performance** path

Prescriptive Path

3. Build home using the measures listed in the **ENERGY STAR Reference Design**

Performance Path

3. Build home using a custom package based on the **ENERGY STAR HERS Index Target**

4. Verify compliance using the **Inspection Checklists**
5. Report and label homes

Evaluate home size

- **Compare home size to Benchmark Home**
  - Conditioned Floor Area (CFA) and bedrooms are defined in the footnotes of the **National Program Requirements** document
  - Homes that are larger than their Benchmark Home Size must use the Performance Path so that the **Size Adjustment Factor** can be applied

Benchmark Home Size

Bedrooms	1	2	3	4	5	6	7	8
CFA	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

- **Determine Size Adjustment Factor**
  - A multiplier between 0 and 1 that lowers the ENERGY STAR HERS Index Target
  - Only applied to homes larger than the Benchmark Home Size

$$SAF = \left(\frac{\text{CFA of Benchmark Home}}{\text{CFA of home to be built}} \right)^{0.25}$$

Select a compliance path

- **Prescriptive Path**
  - A pre-defined set of specifications that must be met. No trade-offs are allowed.
  - Can only be used if home is the same size or smaller than Benchmark Home Size.
  - The home must be designed and constructed to specifications and pass all required inspections and testing.

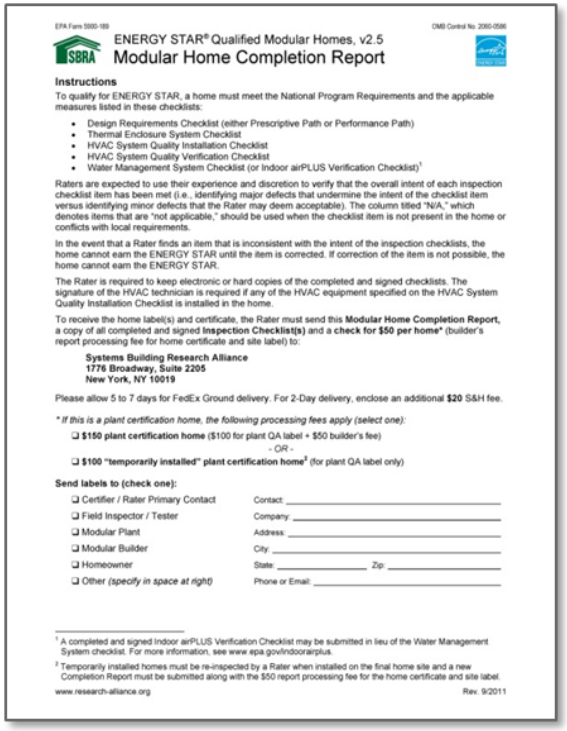
- **Performance Path**
  - A custom set of energy efficiency specifications that achieves the **ENERGY STAR HERS Index Target**—the customized threshold for each home based on the **ENERGY STAR Reference Design** and, for homes larger than their Benchmark Home Size, includes the **Size Adjustment Factor** (SAF).
  - The home must be designed and constructed to the custom specifications and pass all required inspections and testing.

Complete inspection checklists

- **Inspection Checklists**
  - In Version 2.5, all inspection checklists must be completed.
    - ✓ **Design Requirements Checklist**
    - ✓ **Thermal Enclosure System Checklist**
    - ✓ **HVAC System Quality Installation Checklist**
    - ✓ **HVAC System Quality Verification Checklist**
    - ✓ **Water Management System Checklist**
      (or Indoor airPLUS Verification Checklist)
  - Homes must meet all requirements of the Design Requirements Checklist, Section 3–Air Barriers and Section 5—Air Sealing of the Thermal Enclosure System Checklist.
  - Noncompliance with other checklist items will not prevent homes from earning the label under Version 2.5.
  - Compliance with all checklist items will be required under Version 3.

Report qualified homes

- **Modular Home Completion Report**
  - The field verification form completed by the Rater (or the Certifier for plant certification homes) and submitted to SBRA to report qualified homes and request the ENERGY STAR label and home certificate.



EPA Form 5900-189 OMB Control No. 2060-0586

ENERGY STAR® Qualified Modular Homes, v2.5
Modular Home Completion Report

Instructions

To qualify for ENERGY STAR, a home must meet the National Program Requirements and the applicable measures listed in these checklists:

- Design Requirements Checklist (either Prescriptive Path or Performance Path)
- Thermal Enclosure System Checklist
- HVAC System Quality Installation Checklist
- HVAC System Quality Verification Checklist
- Water Management System Checklist (or Indoor airPLUS Verification Checklist)[1]

Raters are expected to use their experience and discretion to verify that the overall intent of each inspection checklist item has been met (i.e., identifying major defects that undermine the intent of the checklist item versus identifying minor defects that the Rater may deem acceptable). The column titled "N/A," which denotes items that are "not applicable," should be used when the checklist item is not present in the home or conflicts with local requirements.

In the event that a Rater finds an item that is inconsistent with the intent of the inspection checklists, the home cannot earn the ENERGY STAR until the item is corrected. If correction of the item is not possible, the home cannot earn the ENERGY STAR.

The Rater is required to keep electronic or hard copies of the completed and signed checklists. The signature of the HVAC technician is required if any of the HVAC equipment specified on the HVAC System Quality Installation Checklist is installed in the home.

To receive the home label(s) and certificate, the Rater must send this **Modular Home Completion Report,** a copy of all completed and signed **Inspection Checklist(s)** and a **check for $50 per home*** (builder's report processing fee for home certificate and site label) to:

Systems Building Research Alliance
1776 Broadway, Suite 2205
New York, NY 10019

Please allow 5 to 7 days for FedEx Ground delivery. For 2-Day delivery, enclose an additional **$20** S&H fee.

** If this is a plant certification home, the following processing fees apply (select one):*

❑ **$150 plant certification home** ($100 for plant QA label + $50 builder's fee)

- OR -

❑ **$100 "temporarily installed" plant certification home**[2] (for plant QA label only)

Send labels to (check one):

❑ Certifier / Rater Primary Contact — Contact: _____
❑ Field Inspector / Tester — Company: _____
❑ Modular Plant — Address: _____
❑ Modular Builder — City: _____
❑ Homeowner — State: _____ Zip: _____
❑ Other *(specify in space at right)* — Phone or Email: _____

[1] A completed and signed Indoor airPLUS Verification Checklist may be submitted in lieu of the Water Management System checklist. For more information, see www.epa.gov/indoorairplus.

[2] Temporarily installed homes must be re-inspected by a Rater when installed on the final home site and a new Completion Report must be submitted along with the $50 report processing fee for the home certificate and site label.

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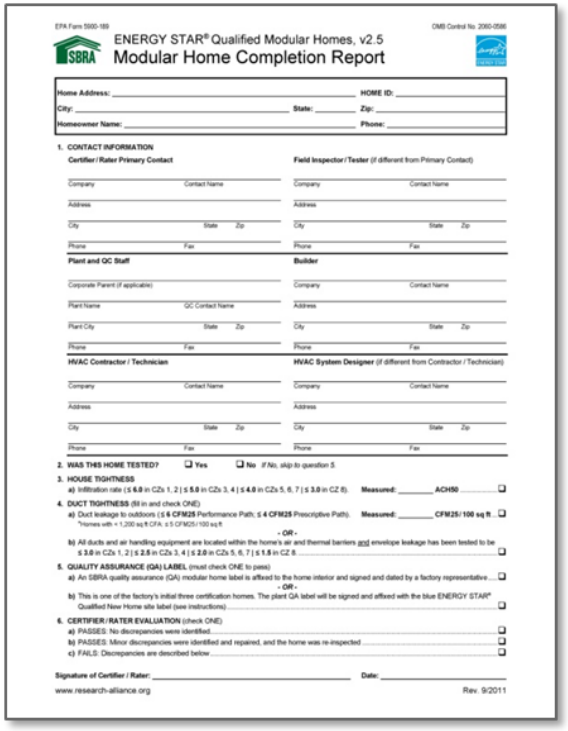

EPA Form 5900-189 OMB Control No. 2060-0586

ENERGY STAR® Qualified Modular Homes, v2.5
Modular Home Completion Report

Home Address: _____ **HOME ID:** _____
City: _____ **State:** _____ **Zip:** _____
Homeowner Name: _____ **Phone:** _____

1. CONTACT INFORMATION

Certifier / Rater Primary Contact — Company; Contact Name; Address; City; State; Zip; Phone; Fax

Field Inspector / Tester (if different from Primary Contact) — Company; Contact Name; Address; City; State; Zip; Phone; Fax

Plant and QC Staff — Corporate Parent (if applicable); Plant Name; QC Contact Name; Plant City; State; Zip; Phone; Fax

Builder — Company; Contact Name; Address; City; State; Zip; Phone; Fax

HVAC Contractor / Technician — Company; Contact Name; Address; City; State; Zip; Phone; Fax

HVAC System Designer (if different from Contractor / Technician) — Company; Contact Name; Address; City; State; Zip; Phone; Fax

2. WAS THIS HOME TESTED? ❑ **Yes** ❑ **No** *If No, skip to question 5.*

3. HOUSE TIGHTNESS
a) Infiltration rate (≤ **6.0** in CZs 1, 2 | ≤ **5.0** in CZs 3, 4 | ≤ **4.0** in CZs 5, 6, 7 | ≤ **3.0** in CZ 8). **Measured:** _____ **ACH50** ❑

4. DUCT TIGHTNESS (fill in and check ONE)
a) Duct leakage to outdoors (≤ **6 CFM25** Performance Path; ≤ **4 CFM25** Prescriptive Path). **Measured:** _____ **CFM25 / 100 sq ft** ❑
*Homes with < 1,200 sq ft CFA: ≤ 5 CFM25 / 100 sq ft

- OR -

b) All ducts and air handling equipment are located within the home's air and thermal barriers and envelope leakage has been tested to be ≤ **3.0** in CZs 1, 2 | ≤ **2.5** in CZs 3, 4 | ≤ **2.0** in CZs 5, 6, 7 | ≤ **1.5** in CZ 8. ❑

5. QUALITY ASSURANCE (QA) LABEL (must check ONE to pass)
a) An SBRA quality assurance (QA) modular home label is affixed to the home interior and signed and dated by a factory representative. ❑

- OR -

b) This is one of the factory's initial three certification homes. The plant QA label will be signed and affixed with the blue ENERGY STAR® Qualified New Home site label (see instructions). ❑

6. CERTIFIER / RATER EVALUATION (check ONE)
a) PASSES: No discrepancies were identified. ❑
b) PASSES: Minor discrepancies were identified and repaired, and the home was re-inspected. ❑
c) FAILS: Discrepancies are described below. ❑

Signature of Certifier / Rater: _____ **Date:** _____

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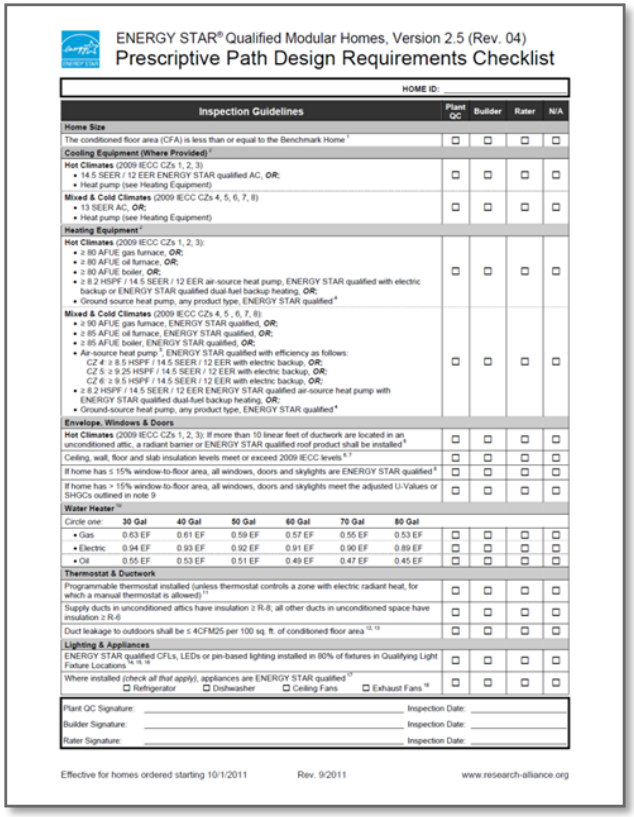
Inspection Checklists

Inspection checklists for v2.5

- **Design Requirements Checklist**
  - Unique to modular homes.
  - Provides a list of features required by the selected compliance path.
  - Provides a place for the plant's QC staff to document compliance with the design and construction specifications.
  - Provides the builder and the Rater with a record of the items inspected in the plant and a list of the items that are to be completed and verified in the field.
  - Full compliance with all checklist items is required for Version 2.5.



ENERGY STAR® Qualified Modular Homes, Version 2.5 (Rev. 04)
Prescriptive Path Design Requirements Checklist

HOME ID: _____

Inspection Guidelines	Plant QC	Builder	Rater	N/A
Home Size				
The conditioned floor area (CFA) is less than or equal to the Benchmark Home [1]	☐	☐	☐	☐
Cooling Equipment (Where Provided) [2]				
Hot Climates (2009 IECC CZs 1, 2, 3) • 14.5 SEER / 12 EER ENERGY STAR qualified AC, **OR;** • Heat pump (see Heating Equipment)	☐	☐	☐	☐
Mixed & Cold Climates (2009 IECC CZs 4, 5, 6, 7, 8) • 13 SEER AC, **OR;** • Heat pump (see Heating Equipment)	☐	☐	☐	☐
Heating Equipment [2]				
Hot Climates (2009 IECC CZs 1, 2, 3): • ≥ 80 AFUE gas furnace, **OR;** • ≥ 80 AFUE oil furnace, **OR;** • ≥ 80 AFUE boiler, **OR;** • ≥ 8.2 HSPF / 14.5 SEER / 12 EER air-source heat pump, ENERGY STAR qualified with electric backup or ENERGY STAR qualified dual-fuel backup heating, **OR;** • Ground source heat pump, any product type, ENERGY STAR qualified [4]	☐	☐	☐	☐
Mixed & Cold Climates (2009 IECC CZs 4, 5 , 6, 7, 8): • ≥ 90 AFUE gas furnace, ENERGY STAR qualified, **OR;** • ≥ 85 AFUE oil furnace, ENERGY STAR qualified, **OR;** • ≥ 85 AFUE boiler, ENERGY STAR qualified, **OR;** • Air-source heat pump [3], ENERGY STAR qualified with efficiency as follows: CZ 4: ≥ 8.5 HSPF / 14.5 SEER / 12 EER with electric backup, **OR;** CZ 5: ≥ 9.25 HSPF / 14.5 SEER / 12 EER with electric backup, **OR;** CZ 6: ≥ 9.5 HSPF / 14.5 SEER / 12 EER with electric backup, **OR;** • ≥ 8.2 HSPF / 14.5 SEER / 12 EER ENERGY STAR qualified air-source heat pump with ENERGY STAR qualified dual-fuel backup heating, **OR;** • Ground-source heat pump, any product type, ENERGY STAR qualified [4]	☐	☐	☐	☐
Envelope, Windows & Doors				
Hot Climates (2009 IECC CZs 1, 2, 3): If more than 10 linear feet of ductwork are located in an unconditioned attic, a radiant barrier or ENERGY STAR qualified roof product shall be installed [5]	☐	☐	☐	☐
Ceiling, wall, floor and slab insulation levels meet or exceed 2009 IECC levels [6,7]	☐	☐	☐	☐
If home has ≤ 15% window-to-floor area, all windows, doors and skylights are ENERGY STAR qualified [8]	☐	☐	☐	☐
If home has > 15% window-to-floor area, all windows, doors and skylights meet the adjusted U-Values or SHGCs outlined in note 9	☐	☐	☐	☐
Water Heater [10]				
Circle one: **30 Gal** **40 Gal** **50 Gal** **60 Gal** **70 Gal** **80 Gal**				
• Gas 0.63 EF 0.61 EF 0.59 EF 0.57 EF 0.55 EF 0.53 EF	☐	☐	☐	☐
• Electric 0.94 EF 0.93 EF 0.92 EF 0.91 EF 0.90 EF 0.89 EF	☐	☐	☐	☐
• Oil 0.55 EF 0.53 EF 0.51 EF 0.49 EF 0.47 EF 0.45 EF	☐	☐	☐	☐
Thermostat & Ductwork				
Programmable thermostat installed (unless thermostat controls a zone with electric radiant heat, for which a manual thermostat is allowed) [11]	☐	☐	☐	☐
Supply ducts in unconditioned attics have insulation ≥ R-8; all other ducts in unconditioned space have insulation ≥ R-6	☐	☐	☐	☐
Duct leakage to outdoors shall be ≤ 4CFM25 per 100 sq. ft. of conditioned floor area [12,13]	☐	☐	☐	☐
Lighting & Appliances				
ENERGY STAR qualified CFLs, LEDs or pin-based lighting installed in 80% of fixtures in Qualifying Light Fixture Locations [14, 15, 16]	☐	☐	☐	☐
Where installed *(check all that apply)*, appliances are ENERGY STAR qualified [17] ☐ Refrigerator ☐ Dishwasher ☐ Ceiling Fans ☐ Exhaust Fans [18]	☐	☐	☐	☐

Plant QC Signature: _____ Inspection Date: _____
Builder Signature: _____ Inspection Date: _____
Rater Signature: _____ Inspection Date: _____

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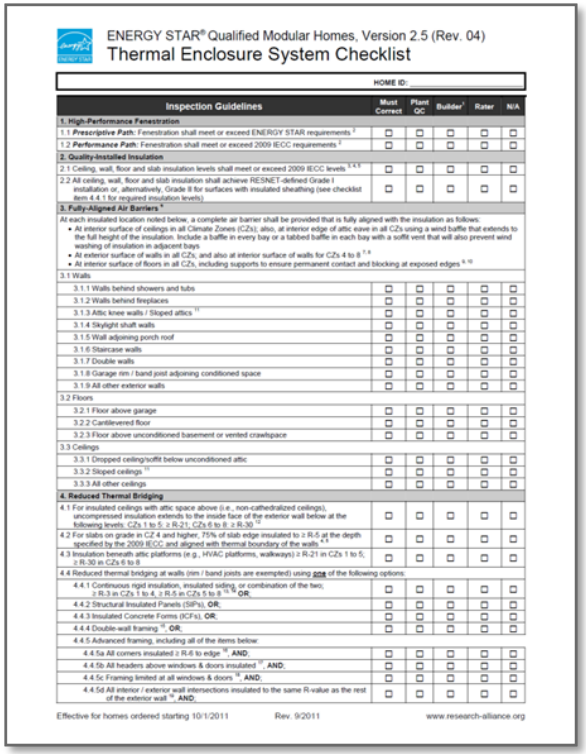
Inspection checklists for v2.5

- **Thermal Enclosure System Checklist**
  - Full compliance with Section 3 Fully-Aligned Air Barriers and Section 5 Air Sealing is required for Version 2.5.
  - Builder can verify up to six items at the Rater's discretion.



ENERGY STAR® Qualified Modular Homes, Version 2.5 (Rev. 04)
Thermal Enclosure System Checklist

HOME ID:

Inspection Guidelines	Must Correct	Plant QC	Builder[2]	Rater	N/A
1. High-Performance Fenestration					
1.1 ***Prescriptive Path***: Fenestration shall meet or exceed ENERGY STAR requirements [2]	☐	☐	☐	☐	☐
1.2 ***Performance Path***: Fenestration shall meet or exceed 2009 IECC requirements [2]	☐	☐	☐	☐	☐
2. Quality-Installed Insulation					
2.1 Ceiling, wall, floor and slab insulation levels shall meet or exceed 2009 IECC levels [3, 4, 5]	☐	☐	☐	☐	☐
2.2 All ceiling, wall, floor and slab insulation shall achieve RESNET-defined Grade I installation or, alternatively, Grade II for surfaces with insulated sheathing (see checklist item 4.4.1 for required insulation levels)	☐	☐	☐	☐	☐
3. Fully-Aligned Air Barriers [6]					
At each insulated location noted below, a complete air barrier shall be provided that is fully aligned with the insulation as follows: • At interior surface of ceilings in all Climate Zones (CZs); also, at interior edge of attic eave in all CZs using a wind baffle that extends to the full height of the insulation. Include a baffle in every bay or a tabbed baffle in each bay with a soffit vent that will also prevent wind washing of insulation in adjacent bays • At exterior surface of walls in all CZs; and also at interior surface of walls for CZs 4 to 8 [7, 8] • At interior surface of floors in all CZs, including supports to ensure permanent contact and blocking at exposed edges [9, 10]					
3.1 Walls					
3.1.1 Walls behind showers and tubs	☐	☐	☐	☐	☐
3.1.2 Walls behind fireplaces	☐	☐	☐	☐	☐
3.1.3 Attic knee walls / Sloped attics [11]	☐	☐	☐	☐	☐
3.1.4 Skylight shaft walls	☐	☐	☐	☐	☐
3.1.5 Wall adjoining porch roof	☐	☐	☐	☐	☐
3.1.6 Staircase walls	☐	☐	☐	☐	☐
3.1.7 Double walls	☐	☐	☐	☐	☐
3.1.8 Garage rim / band joist adjoining conditioned space	☐	☐	☐	☐	☐
3.1.9 All other exterior walls	☐	☐	☐	☐	☐
3.2 Floors					
3.2.1 Floor above garage	☐	☐	☐	☐	☐
3.2.2 Cantilevered floor	☐	☐	☐	☐	☐
3.2.3 Floor above unconditioned basement or vented crawlspace	☐	☐	☐	☐	☐
3.3 Ceilings					
3.3.1 Dropped ceiling/soffit below unconditioned attic	☐	☐	☐	☐	☐
3.3.2 Sloped ceilings [11]	☐	☐	☐	☐	☐
3.3.3 All other ceilings	☐	☐	☐	☐	☐
4. Reduced Thermal Bridging					
4.1 For insulated ceilings with attic space above (i.e., non-cathedralized ceilings), uncompressed insulation extends to the inside face of the exterior wall below at the following levels: CZs 1 to 5: ≥ R-21; CZs 6 to 8: ≥ R-30 [12]	☐	☐	☐	☐	☐
4.2 For slabs on grade in CZ 4 and higher, 75% of slab edge insulated to ≥ R-5 at the depth specified by the 2009 IECC and aligned with thermal boundary of the walls [4, 5]	☐	☐	☐	☐	☐
4.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) ≥ R-21 in CZs 1 to 5; ≥ R-30 in CZs 6 to 8	☐	☐	☐	☐	☐
4.4 Reduced thermal bridging at walls (rim / band joists are exempted) using **one** of the following options:					
4.4.1 Continuous rigid insulation, insulated siding, or combination of the two; ≥ R-3 in CZs 1 to 4, ≥ R-5 in CZs 5 to 8 [13, 14] **OR**;	☐	☐	☐	☐	☐
4.4.2 Structural Insulated Panels (SIPs), **OR**;	☐	☐	☐	☐	☐
4.4.3 Insulated Concrete Forms (ICFs), **OR**;	☐	☐	☐	☐	☐
4.4.4 Double-wall framing [15], **OR**;	☐	☐	☐	☐	☐
4.4.5 Advanced framing, including all of the items below:					
4.4.5a All corners insulated ≥ R-6 to edge [16], **AND**;	☐	☐	☐	☐	☐
4.4.5b All headers above windows & doors insulated [17], **AND**;	☐	☐	☐	☐	☐
4.4.5c Framing limited at all windows & doors [18], **AND**;	☐	☐	☐	☐	☐
4.4.5d All interior / exterior wall intersections insulated to the same R-value as the rest of the exterior wall [19], **AND**;	☐	☐	☐	☐	☐

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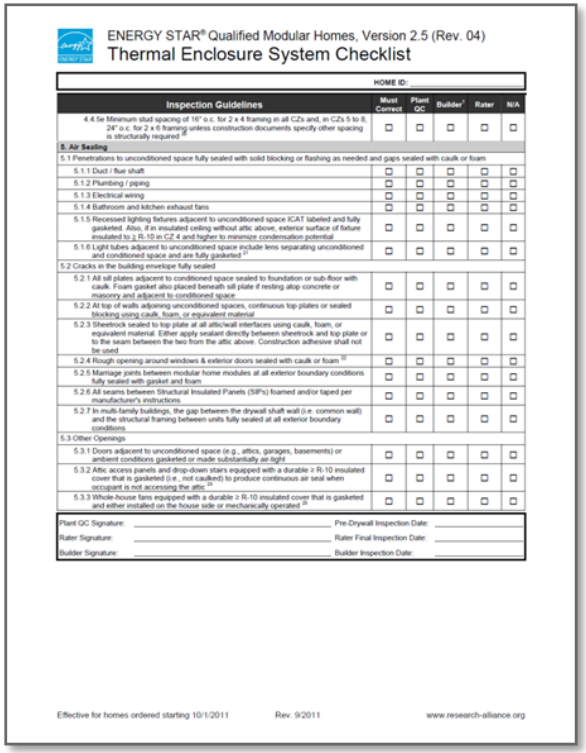


ENERGY STAR® Qualified Modular Homes, Version 2.5 (Rev. 04)
Thermal Enclosure System Checklist

HOME ID:

Inspection Guidelines	Must Correct	Plant QC	Builder[2]	Rater	N/A
4.4.5e Minimum stud spacing of 16" o.c. for 2 x 4 framing in all CZs and, in CZs 5 to 8, 24" o.c. for 2 x 6 framing unless construction documents specify other spacing is structurally required [20]	☐	☐	☐	☐	☐
5. Air Sealing					
5.1 Penetrations to unconditioned space fully sealed with solid blocking or flashing as needed and gaps sealed with caulk or foam					
5.1.1 Duct / flue shaft	☐	☐	☐	☐	☐
5.1.2 Plumbing / piping	☐	☐	☐	☐	☐
5.1.3 Electrical wiring	☐	☐	☐	☐	☐
5.1.4 Bathroom and kitchen exhaust fans	☐	☐	☐	☐	☐
5.1.5 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and fully gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4 and higher to minimize condensation potential	☐	☐	☐	☐	☐
5.1.6 Light tubes adjacent to unconditioned space include lens separating unconditioned and conditioned space and are fully gasketed [21]	☐	☐	☐	☐	☐
5.2 Cracks in the building envelope fully sealed					
5.2.1 All sill plates adjacent to conditioned space sealed to foundation or sub-floor with caulk. Foam gasket also placed beneath sill plate if resting atop concrete or masonry and adjacent to conditioned space	☐	☐	☐	☐	☐
5.2.2 At top of walls adjoining unconditioned spaces, continuous top plates or sealed blocking using caulk, foam, or equivalent material	☐	☐	☐	☐	☐
5.2.3 Sheetrock sealed to top plate at all attic/wall interfaces using caulk, foam, or equivalent material. Either apply sealant directly between sheetrock and top plate or to the seam between the two from the attic above. Construction adhesive shall not be used	☐	☐	☐	☐	☐
5.2.4 Rough opening around windows & exterior doors sealed with caulk or foam [22]	☐	☐	☐	☐	☐
5.2.5 Marriage joints between modular home modules at all exterior boundary conditions fully sealed with gasket and foam	☐	☐	☐	☐	☐
5.2.6 All seams between Structural Insulated Panels (SIPs) foamed and/or taped per manufacturer's instructions	☐	☐	☐	☐	☐
5.2.7 In multi-family buildings, the gap between the drywall shaft wall (i.e. common wall) and the structural framing between units fully sealed at all exterior boundary conditions	☐	☐	☐	☐	☐
5.3 Other Openings					
5.3.1 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions gasketed or made substantially air-tight	☐	☐	☐	☐	☐
5.3.2 Attic access panels and drop-down stairs equipped with a durable ≥ R-10 insulated cover that is gasketed (i.e., not caulked) to produce continuous air seal when occupant is not accessing the attic [23]	☐	☐	☐	☐	☐
5.3.3 Whole-house fans equipped with a durable ≥ R-10 insulated cover that is gasketed and either installed on the house side or mechanically operated [24]	☐	☐	☐	☐	☐

Plant QC Signature: _____ Pre-Drywall Inspection Date: _____
Rater Signature: _____ Rater Final Inspection Date: _____
Builder Signature: _____ Builder Inspection Date: _____

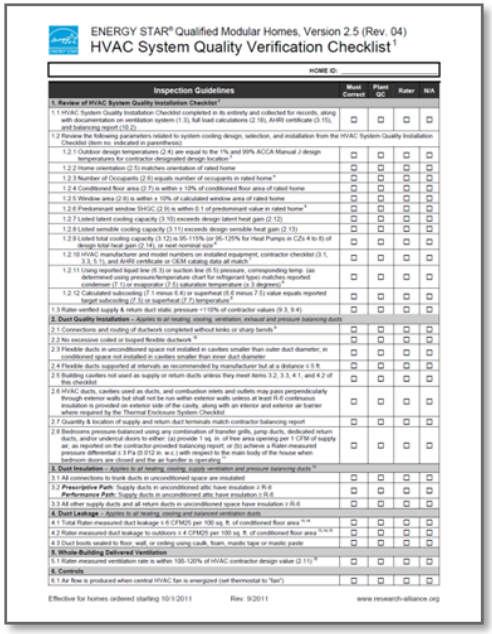
Effective for homes ordered starting 10/1/2011 Rev. 9/2011 www.research-alliance.org

Inspection checklists for v2.5

- **HVAC System Quality Installation Checklist**
  - Ensures that the HVAC systems are designed and installed according to industry-accepted quality installation practices.
  - **To be completed by the Plant and the HVAC contractor**.
  - The Rater will validate some key data points, but is NOT responsible for verifying the accuracy of load calculations.
  - For Version 2.5, Checklist must be completed, but homes will not be denied the ENERGY STAR label for deficiencies.

Inspection checklists for v2.5

- **HVAC System Quality Verification Checklist**
  - Used to verify that the home's ductwork and ventilation system have been installed properly and to validate HVAC contractor's work.
  - **To be completed by the Rater**.
  - For Version 2.5, Checklist must be completed, but homes will not be denied the ENERGY STAR label for deficiencies.



ENERGY STAR® Qualified Modular Homes, Version 2.5 (Rev. 04)
HVAC System Quality Verification Checklist[1]

HOME ID: _____

Inspection Guidelines	Must Correct	Plant QC	Rater	N/A
1. Review of HVAC System Quality Installation Checklist[2]				
1.1 HVAC System Quality Installation Checklist completed in its entirety and collected for records, along with documentation on ventilation system (1.3), full load calculations (2.16), AHRI certificate (3.15), and balancing report (10.2).	☐	☐	☐	☐
1.2 Review the following parameters related to system cooling design, selection, and installation from the HVAC System Quality Installation Checklist (item no. indicated in parenthesis):				
1.2.1 Outdoor design temperatures (2.4) are equal to the 1% and 99% ACCA Manual J design temperatures for contractor-designated design location[3]	☐	☐	☐	☐
1.2.2 Home orientation (2.5) matches orientation of rated home	☐	☐	☐	☐
1.2.3 Number of Occupants (2.6) equals number of occupants in rated home[4]	☐	☐	☐	☐
1.2.4 Conditioned floor area (2.7) is within ± 10% of conditioned floor area of rated home	☐	☐	☐	☐
1.2.5 Window area (2.8) is within ± 10% of calculated window area of rated home	☐	☐	☐	☐
1.2.6 Predominant window SHGC (2.9) is within 0.1 of predominant value in rated home[5]	☐	☐	☐	☐
1.2.7 Listed latent cooling capacity (3.10) exceeds design latent heat gain (2.12)	☐	☐	☐	☐
1.2.8 Listed sensible cooling capacity (3.11) exceeds design sensible heat gain (2.13)	☐	☐	☐	☐
1.2.9 Listed total cooling capacity (3.12) is 95-115% (or 95-125% for Heat Pumps in CZs 4 to 8) of design total heat gain (2.14), or next nominal size[6]	☐	☐	☐	☐
1.2.10 HVAC manufacturer and model numbers on installed equipment, contractor checklist (3.1, 3.3, 3.1), and AHRI certificate or OEM catalog data all match[7]	☐	☐	☐	☐
1.2.11 Using reported liquid line (6.3) or suction line (6.5) pressure, corresponding temp. (as determined using pressure/temperature chart for refrigerant type) matches reported condenser (7.1) or evaporator (7.5) saturation temperature (± 3 degrees)[7]	☐	☐	☐	☐
1.2.12 Calculated subcooling (7.1 minus 6.4) or superheat (6.6 minus 7.5) value equals reported target subcooling (7.3) or superheat (7.7) temperature[8]	☐	☐	☐	☐
1.3 Rater-verified supply & return duct static pressure <110% of contractor values (9.3, 9.4)	☐	☐	☐	☐
2. Duct Quality Installation – Applies to all heating, cooling, ventilation, exhaust and pressure balancing ducts				
2.1 Connections and routing of ductwork completed without kinks or sharp bends[9]	☐	☐	☐	☐
2.2 No excessive coiled or looped flexible ductwork[10]	☐	☐	☐	☐
2.3 Flexible ducts in unconditioned space not installed in cavities smaller than outer duct diameter; in conditioned space not installed in cavities smaller than inner duct diameter	☐	☐	☐	☐
2.4 Flexible ducts supported at intervals as recommended by manufacturer but at a distance ≤ 5 ft.	☐	☐	☐	☐
2.5 Building cavities not used as supply or return ducts unless they meet items 3.2, 3.3, 4.1, and 4.2 of this checklist	☐	☐	☐	☐
2.6 HVAC ducts, cavities used as ducts, and combustion inlets and outlets may pass perpendicularly through exterior walls but shall not be run within exterior walls unless at least R-6 continuous insulation is provided on exterior side of the cavity, along with an interior and exterior air barrier where required by the Thermal Enclosure System Checklist	☐	☐	☐	☐
2.7 Quantity & location of supply and return duct terminals match contractor balancing report	☐	☐	☐	☐
2.8 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and/or undercut doors to either: (a) provide 1 sq. in. of free area opening per 1 CFM of supply air, as reported on the contractor-provided balancing report, or (b) achieve a Rater-measured pressure differential ≤ 3 Pa (0.012 in. w.c.) with respect to the main body of the house when bedroom doors are closed and the air handler is operating.	☐	☐	☐	☐
3. Duct Insulation – Applies to all heating, cooling, supply ventilation and pressure balancing ducts[11]				
3.1 All connections to trunk ducts in unconditioned space are insulated	☐	☐	☐	☐
3.2 ***Prescriptive Path***: Supply ducts in unconditioned attic have insulation ≥ R-8 ***Performance Path***: Supply ducts in unconditioned attic have insulation ≥ R-6	☐	☐	☐	☐
3.3 All other supply ducts and all return ducts in unconditioned space have insulation ≥ R-6	☐	☐	☐	☐
4. Duct Leakage – Applies to all heating, cooling and balanced ventilation ducts				
4.1 Total Rater-measured duct leakage ≤ 6 CFM25 per 100 sq. ft. of conditioned floor area[12,14]	☐	☐	☐	☐
4.2 Rater-measured duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area[12,13,15]	☐	☐	☐	☐
4.3 Duct boots sealed to floor, wall, or ceiling using caulk, foam, mastic tape or mastic paste	☐	☐	☐	☐
5. Whole-Building Delivered Ventilation				
5.1 Rater-measured ventilation rate is within 100-120% of HVAC contractor design value (2.11)[16]	☐	☐	☐	☐
6. Controls				
6.1 Air flow is produced when central HVAC fan is energized (set thermostat to "fan")	☐	☐	☐	☐

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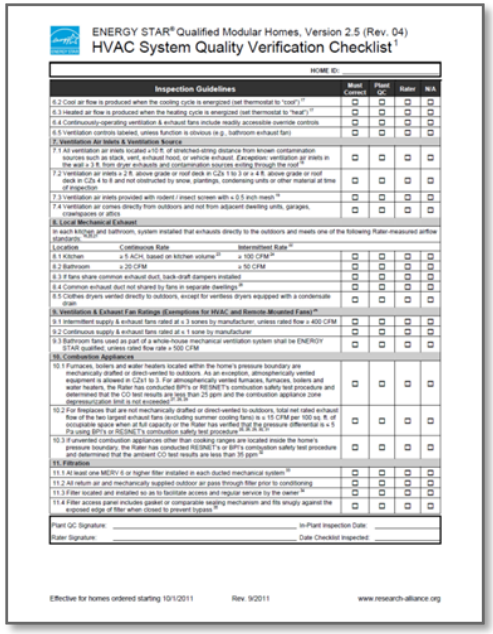

ENERGY STAR® Qualified Modular Homes, Version 2.5 (Rev. 04)
HVAC System Quality Verification Checklist[1]

HOME ID: _____

Inspection Guidelines	Must Correct	Plant QC	Rater	N/A
6.2 Cool air flow is produced when the cooling cycle is energized (set thermostat to "cool")[17]	☐	☐	☐	☐
6.3 Heated air flow is produced when the heating cycle is energized (set thermostat to "heat")[17]	☐	☐	☐	☐
6.4 Continuously-operating ventilation & exhaust fans include readily accessible override controls	☐	☐	☐	☐
6.5 Ventilation controls labeled; unless function is obvious (e.g., bathroom exhaust fan)	☐	☐	☐	☐
7. Ventilation Air Inlets & Ventilation Source				
7.1 All ventilation air inlets located ≥10 ft. of stretched-string distance from known contamination sources such as stack, vent, exhaust hood, or vehicle exhaust. *Exception:* ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof[18]	☐	☐	☐	☐
7.2 Ventilation air inlets ≥ 2 ft. above grade or roof deck in CZs 1 to 3 or ≥ 4 ft. above grade or roof deck in CZs 4 to 8 and not obstructed by snow, plantings, condensing units or other material at time of inspection	☐	☐	☐	☐
7.3 Ventilation air inlets provided with rodent / insect screen with ≤ 0.5 inch mesh[19]	☐	☐	☐	☐
7.4 Ventilation air comes directly from outdoors and not from adjacent dwelling units, garages, crawlspaces or attics	☐	☐	☐	☐
8. Local Mechanical Exhaust				
In each kitchen and bathroom, system installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow standards: [20,21,22]				
Location — Continuous Rate — Intermittent Rate[23]				
8.1 Kitchen — ≥ 5 ACH, based on kitchen volume[24] — ≥ 100 CFM[24]	☐	☐	☐	☐
8.2 Bathroom — ≥ 20 CFM — ≥ 50 CFM	☐	☐	☐	☐
8.3 If fans share common exhaust duct, back-draft dampers installed	☐	☐	☐	☐
8.4 Common exhaust duct not shared by fans in separate dwellings[25]	☐	☐	☐	☐
8.5 Clothes dryers vented directly to outdoors, except for ventless dryers equipped with a condensate drain	☐	☐	☐	☐
9. Ventilation & Exhaust Fan Ratings (Exemptions for HVAC and Remote Mounted Fans)[26]				
9.1 Intermittent supply & exhaust fans rated at ≥ 3 sones by manufacturer, unless rated flow ≥ 400 CFM	☐	☐	☐	☐
9.2 Continuous supply & exhaust fans rated at ≤ 1 sone by manufacturer	☐	☐	☐	☐
9.3 Bathroom fans used as part of a whole-house mechanical ventilation system shall be ENERGY STAR qualified, unless rated flow rate > 500 CFM	☐	☐	☐	☐
10. Combustion Appliances				
10.1 Furnaces, boilers and water heaters located within the home's pressure boundary are mechanically drafted or direct-vented to outdoors. As an exception, atmospherically vented equipment is allowed in CZs1 to 3. For atmospherically vented furnaces, furnaces, boilers and water heaters, the Rater has conducted BPI's or RESNET's combustion safety test procedure and determined that the CO test results are less than 25 ppm and the combustion appliance zone depressurization limit is not exceeded.[27,28,29]	☐	☐	☐	☐
10.2 For fireplaces that are not mechanically drafted or direct-vented to outdoors, total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is ≤ 15 CFM per 100 sq. ft. of occupiable space when at full capacity or the Rater has verified that the pressure differential is ≤ 5 Pa using BPI's or RESNET's combustion safety test procedure.[28,29,30,31]	☐	☐	☐	☐
10.3 If unvented combustion appliances other than cooking ranges are located inside the home's pressure boundary, the Rater has conducted RESNET's or BPI's combustion safety test procedure and determined that the ambient CO test results are less than 35 ppm.[32]	☐	☐	☐	☐
11. Filtration				
11.1 At least one MERV 6 or higher filter installed in each ducted mechanical system[33]	☐	☐	☐	☐
11.2 All return air and mechanically supplied outdoor air pass through filter prior to conditioning	☐	☐	☐	☐
11.3 Filter located and installed so as to facilitate access and regular service by the owner[34]	☐	☐	☐	☐
11.4 Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass[35]	☐	☐	☐	☐

Plant QC Signature: _____ In-Plant Inspection Date: _____

Rater Signature: _____ Date Checklist Inspected: _____

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Inspection checklists for v2.5

- **Water Management System Checklist**
  - Requires inspection of key areas to help assure bulk moisture control, including water-managed foundation, walls, roofs and building materials.
  - **To be completed by the Plant and the Builder**.
  - Rater may also verify items on the Checklist. However, the Plant and the Builder are responsible for accuracy of all Checklist requirements.
  - For Version 2.5, this Checklist must be completed, but homes will not be denied the ENERGY STAR label for deficiencies.

As an alternative, the **Indoor airPLUS** Verification Checklist can be completed. The learn more about how homes can be qualified to earn EPA's Indoor airPLUS label, visit www.epa.gov/indoorairplus

Action Items for Version 2.5

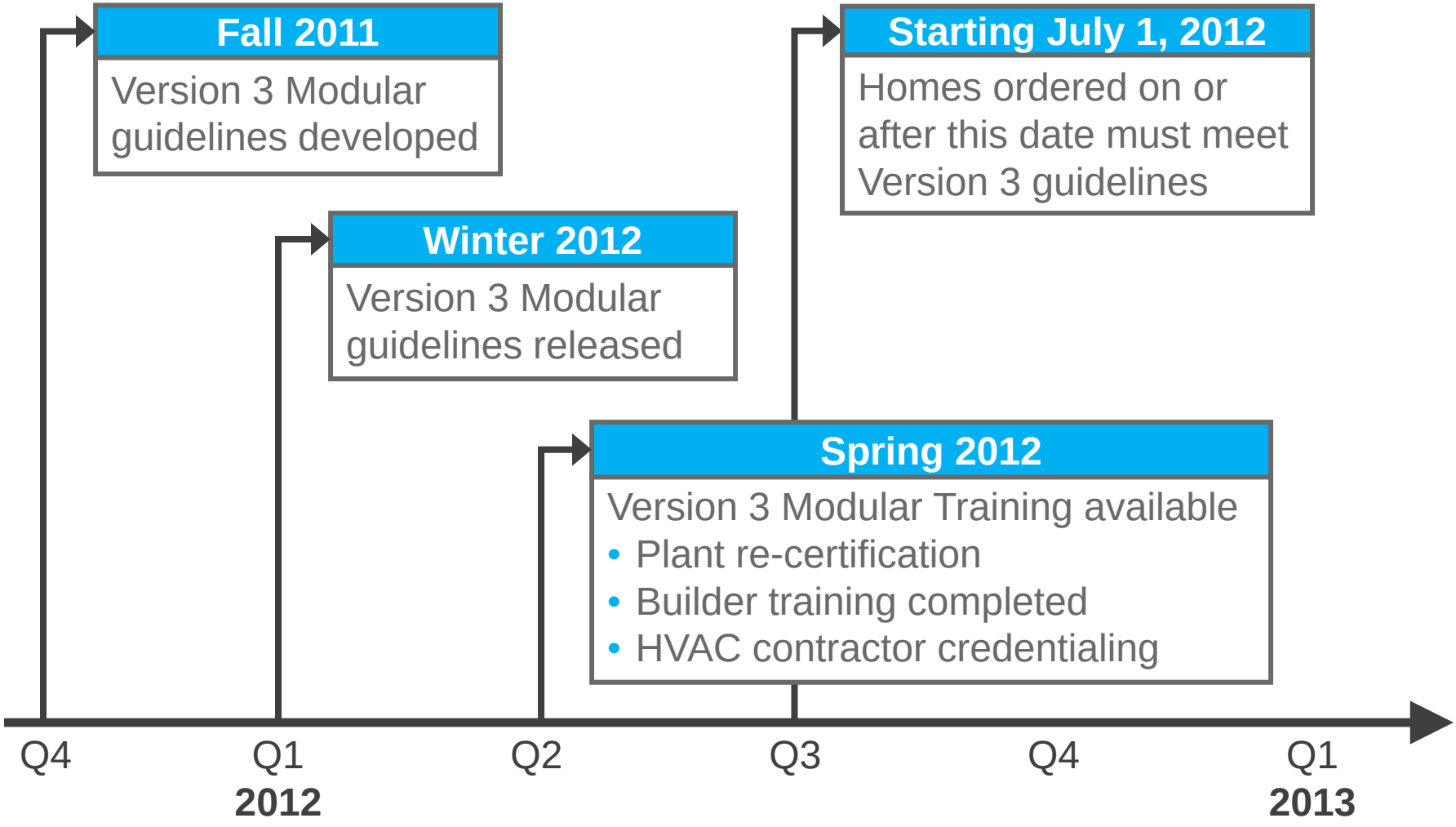
Action items

- **Review plant's designs and QC procedures for Version 2.5**
  - Certifiers should work with plants to incorporate the Version 2.5 energy efficiency requirements and checklist items into the plant's plans and procedures during the next scheduled six-month, in-plant inspection.
  - Recommended that this occur before plant begins building homes to Version 2.5 guidelines.

- **Educate the Builder**
  - Plant, Certifier and Rater should work together to educate the Builder on the Builder's and HVAC contractor's added responsibilities under Version 2.5.
  - Builders are encouraged to participate in an online ENERGY STAR Version 2.5 webinar that will be broadcast in late October or early November 2011.

Getting to Version 3 for Modular Homes

Getting to Version 3



Resources

Modular resources from SBRA

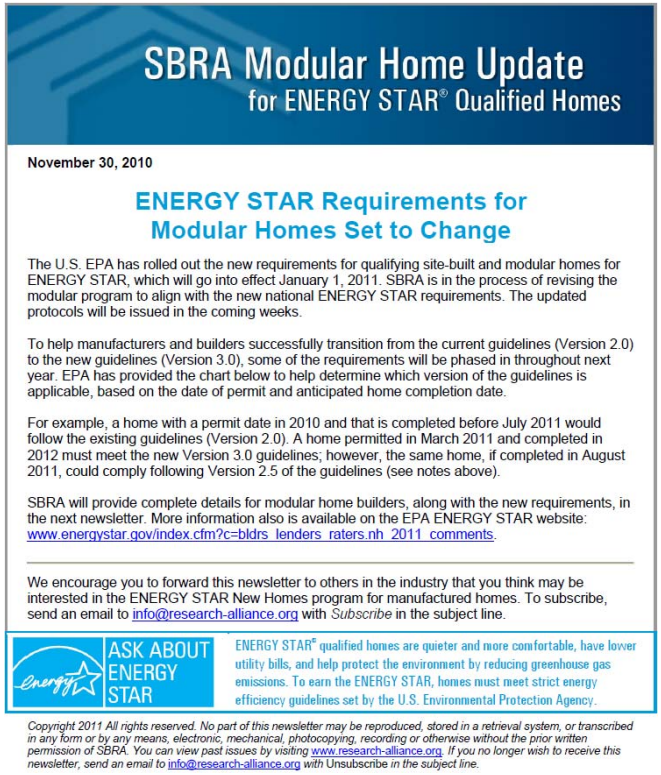
- **Modular Housing Program v2.5 Guidelines**
  - Comprehensive program guidebook available on the SBRA website: www.research-alliance.org/pages/es_mod.htm

- **SBRA Modular Home Update e-newsletter**

- **Contact SBRA**

gkoch@research-alliance.org
212-496-0900 x120

- **Find us on Facebook**



SBRA Modular Home Update
for ENERGY STAR® Qualified Homes

November 30, 2010

ENERGY STAR Requirements for Modular Homes Set to Change

The U.S. EPA has rolled out the new requirements for qualifying site-built and modular homes for ENERGY STAR, which will go into effect January 1, 2011. SBRA is in the process of revising the modular program to align with the new national ENERGY STAR requirements. The updated protocols will be issued in the coming weeks.

To help manufacturers and builders successfully transition from the current guidelines (Version 2.0) to the new guidelines (Version 3.0), some of the requirements will be phased in throughout next year. EPA has provided the chart below to help determine which version of the guidelines is applicable, based on the date of permit and anticipated home completion date.

For example, a home with a permit date in 2010 and that is completed before July 2011 would follow the existing guidelines (Version 2.0). A home permitted in March 2011 and completed in 2012 must meet the new Version 3.0 guidelines; however, the same home, if completed in August 2011, could comply following Version 2.5 of the guidelines (see notes above).

SBRA will provide complete details for modular home builders, along with the new requirements, in the next newsletter. More information also is available on the EPA ENERGY STAR website: www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments.

We encourage you to forward this newsletter to others in the industry that you think may be interested in the ENERGY STAR New Homes program for manufactured homes. To subscribe, send an email to info@research-alliance.org with *Subscribe* in the subject line.

ASK ABOUT ENERGY STAR

ENERGY STAR® qualified homes are quieter and more comfortable, have lower utility bills, and help protect the environment by reducing greenhouse gas emissions. To earn the ENERGY STAR, homes must meet strict energy efficiency guidelines set by the U.S. Environmental Protection Agency.

General resources from EPA

- **Checklist item questions**
  - Consult the checklist guidebooks, which explain the rationale and installation standards for each item.
- **HVAC contractor requirements**
  - Before working on homes qualified under Version 3, HVAC contractors must complete the Version 3 Training and be credentialed
  - For information on HVAC contractor credentialing, visit www.energystar.gov/newhomeshvac
- **ENERGY STAR brand guidelines**
  www.energystar.gov/logos
- **ENERGY STAR for New Homes**
  www.energystar.gov/newhomespartners

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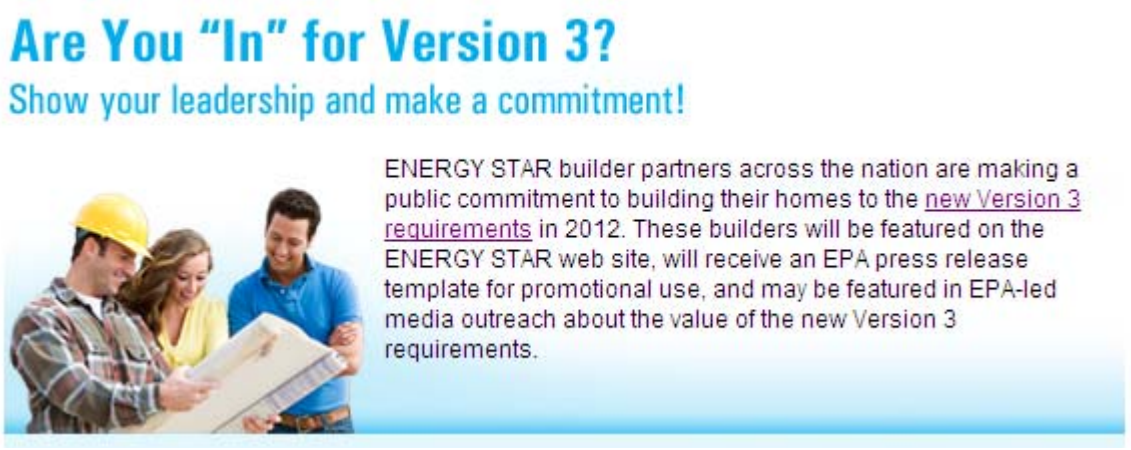
General resources from EPA

- **Build momentum in your market by participating in the We're In! Campaign**
  - Builders committed to qualifying homes under Version 3 can make that commitment public and be recognized for their early leadership.
  - Builders can make the commitment for some or all of their homes.
  - Participants will receive a press release from EPA to use in media outreach, will be showcased on EPA's website, and may be featured in EPA's own media outreach.
  - www.energystar.gov/v3commitment



Thank you!

Q&A